

MEMOIR 1: MIAMI GEOLOGICAL SOCIETY

A SYMPOSIUM OF RECENT SOUTH FLORIDA FORAMINIFERA

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A HANDBOOK OF THE BENTHONIC FORAMINIFERA  
OF FLORIDA BAY AND ADJACENT WATERS<sup>1</sup>

by

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## ABSTRACT

Sediment samples from 108 stations in and around Florida Bay were examined for their benthonic foraminiferal content. 235 species belonging to 99 genera were identified. Five faunal groups were recognized and these correlated in a general way with areal changes in the physical environment.

## INTRODUCTION

Florida Bay and the adjacent waters offer an excellent opportunity to study a warm, shallow-water fauna from an area of dominantly calcareous sediments. This paper deals primarily with the taxonomy of the benthonic foraminiferal species and their distribution in the sediments. The total fauna is described. Sample coverage includes 108 stations from which 99 genera and 235 species were identified.

## PREVIOUS WORK

Vaughn (1918) compared shallow-water bottom samples from Murray Island, Australia, with samples from Florida and the Bahamas, including five samples from the Florida Keys and the Tortugas. Cushman identified the species of Foraminifera present in the samples and found Orbiculina adunca (Fichtel and Moll) to be the most abundant form in the Florida Keys.

Later Cushman (1922) made an ecological study of the shallow-water Foraminifera of the Dry Tortugas, and included observations of living Foraminifera.

Norton (1930) conducted an ecological study of Foraminifera from the waters of Australia and from the Floridian-Bahamian region. In this study he grouped the Foraminifera into several ecological zones based on depth and temperature. The Peneroplidae and Miliolidae were found to be the most abundant in the shallowest and warmest waters, and he noted that these families decreased in abundance with depth.

Thorp (1939), in a study of calcareous marine deposits from the Floridian and Bahamian regions found the Foraminifera to be widely distributed, comprising about 9% of the deposits. The most abundant genera were Archaias, Peneroplis, Quinqueloculina, Clavulina and Valvulina. He also noted that occasionally pelagic forms were swept into the shallow waters by waves and currents, contaminating the shallow-water benthonic faunal deposits.

Stubbs (1940) made an investigation of the Foraminifera from the vicinity of Biscayne Bay. He described 23 genera and 61 species of which the Miliolidae and Peneroplidae were the pre-dominant families. Archaias angulatus was found to be the most abundant species.

Bush (1949, 1958) made two studies of the distribution of Foraminifera in Biscayne Bay. The first described the general distribution of the Foraminifera. The second and more comprehensive study described the sediments and ecological distribution of the Foraminifera. He recognized thirteen biotopes in Biscayne Bay which were dominated by porcelaneous species, but with some containing a significant number of agglutinated and perforate species.

Moore (1957) made an ecological study of the Foraminifera in the northern Florida Keys. He divided the Foraminifera into faunal provinces including Florida Bay, back-reef, reef and fore-reef. The Florida Bay environment was dominated by the Peneroplidae, Miliolidae and Nonionidae with the families Amphisteginidae, Textulariidae, Lagenidae and Buliminidae present. He stated that only species of the family Miliolidae were living in the Florida Bay environment, and that the Florida Bay fauna was distributed by current and wave action.

Lynts (1962, 1965) made a study of the distribution of the Foraminifera in upper Florida Bay. He came to the conclusion that sediment size could be a controlling factor in the distribution of certain Foraminifera. In a second study he discussed the following species from Florida Bay: Valvulina oviedoiana d'Orbigny, Triloculina bassensis Parr and Bolivinita rhomboidalis (Millett).

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## PROCEDURES

Bottom sediment samples were collected from small boats and the R/V Gerda from 1958 through 1963. These samples were collected from 108 locations by gravity coring, dredging and hand-sampling in an area bounded by 24°20'N--25°40'N and 80°00'W--83°00'W (see Fig. 1). The samples were preserved in buffered formulin during transportation to the laboratory where they were washed and dried. The dried samples were subdivided with a microsplitter and 250 mg. portions were picked of all Foraminifera.

## DISTRIBUTION OF BENTHONIC FORAMINIFERA

Five faunal groups may be distinguished in the area investigated:

1) Straits fauna, 2) back-reef fauna, 3) brackish-water fauna, 4) bay fauna and 5) Gulf fauna.

Straits fauna. (Stations 1, depth 507 m.). Although this faunal assemblage was taken from a single station it is included to emphasize the faunal differences between the various habitats. The major factor controlling faunal distribution within this group is depth. The most abundant species are: Cibicides cicatricosus, Hoeglundina elegans and Pyrgo comata. Lesser elements include Cassidulina subglobosa, Ehrenbergina pacifica, Pyrgo fornasinii, Pyrulina cylindroides, Rectobolivina advena, Robertinoides bradyi, Spiroloculina soldanii, Technitella legumen, and Trifarina bradyi.

Back-reef fauna. (Stations 2-4, depth 1.4-8.5 m.). This group has specimens in common with the bay fauna, but is sufficiently different to be recognizable. The major distinguishing species are: Discorbis rosea, Homotrema rubrum and Pyrgo murrhina. Lesser elements include: Fissurina wiesneri, Ammodiscus anguillae, A. tenuis, Laticarenina holophora, Pyrgo elongata, Schlumbergerina alveoliniformis var. occidentalis and Spiroloculina rotunda. It has two characteristic species in common with the Gulf fauna: Textularia agglutinans and Uvigerina flintii.

Brackish-water fauna. (Stations 9-15, depth 1.2-1.8 m.). This group is characteristic of the small bays immediately adjacent to the Florida mainland. These bays are subject to pronounced runoff of fresh water during the wet season and evaporation during the dry season, and therefore the fauna in them is controlled predominantly by salinity. There are only two species characteristic of this group: Ammonia beccarii var. parkinsoniana and Elphidium discoidale. Although these species are preset in other groups they never occur in large percentages other than in the brackish-water areas, where they may be the only species present.

Gulf fauna. (Stations 98-108, depth 14.8-95 m.). This group is characterized by the following species: Bigenenerina irregularis, B. nodosaris, B. textularioidea, Eponides repandus, Marginulina planata, Lenticulina calcar, L. iota, Quinqueloculina bicostata, Spiroplectammina floridana, Textularia agglutinans, T. candeiana, Textulariella barrettii, Uvigerina flintii, U. peregrina and Textularia mayori. There are many minor species found in this group. The distribution of individual species is discussed in the section on Systematic Paleontology.

Bay fauna. (Stations 5-8, 16-97, depth 0.3-6.2 m.). This group contains a very large number of species of which only the most abundant are listed here. It includes: Articulina lineata, A. mayori, A. mexicana, A. mucronata, A. multilocularis, A. pacifica, A. sagra, Bolivina lanceolata, B. lowmani, B. paula, B. pulchella var. primitiva, B. striatula, Cyclogyra involvens, C. planorbis, Rosalina floridana, Cymbaloporeta squamosa, Neoconorbina orbicularis, Elphidium advenum, E. sagram, Criboelphidium poeyanum, Eponides antillarum, Fursenkoina complanata, F. compressa, F. pontoni, Hauerina bradyi, Miliolinella circularis, M. fichteliana, M. labiosa, M. suborbicularis,

Nonion depressulum var. matagordanum, N. grateloupi, Peneroplis pertusus, Broeckina orbitolitoides, Pyrgo denticulata, P. subsphaerica, Quinqueloculina bidentata, Q. bosciana, Q. laevigata, Q. lamarckiana, Q. poeyana, Q. polygona, Q. tenagos, Q. sabulosa, Q. seminula, Q. subpoeyana, Q. tricarinata, Q. wiesneri, Sorites marginalis, Spirillina vivipara, Spiroloculina antillarum, S. arenata, Spirolina acicularis, S. arietinus, Triloculina bassensis, T. bermudezi, T. bicarinata, T. carinata, T. fitterei var. meningi, T. linneiana, T. oblonga, T. planiana, T. rotunda, T. sidebottomi, T. tricarinata, T. trigonula and Valvulina oviedoiana. All the above species appear to be able to tolerate major changes in both temperature and salinity.

An additional factor in the bay fauna which affects the distribution of dead tests is sorting by wave and current action resulting in the larger species associated with the coarsest sediment while the smaller are seemingly confined to the finest sediment.

## CONCLUSIONS

Ninety nine genera and 235 species are represented in the sediments from Florida Bay and adjacent waters. Five faunal groups are recognized which are apparently characteristic of different environments: the Straits and Gulf faunas controlled by depth; the back-reef and bay faunas controlled by temperature and salinity; and the brackish-water fauna controlled primarily by salinity. The bay fauna's distribution appears to be secondarily controlled by wave and current action.

## SYSTEMATIC PALEONTOLOGY

The classification followed here is the one adopted by Loeblich and Tappan (1964) in the Treatise on Invertebrate Paleontology.

ORDER FORAMINIFERIDA Eichwald, 1830  
 SUBORDER TEXTULARINA Delage and Herouard, 1896  
 SUPERFAMILY AMMODISCACEA Reuss, 1862  
 FAMILY ASTORRHIZIDAE Brady, 1881  
 SUBFAMILY HIPPOCREPININAE Rumbler, 1895  
 GENUS HYPERAMMINA Brady, 1878  
Hyperammina elongata Brady, 1878 (Plate 1, Fig. 1)

Hyperammina elongata Brady (part), 1878, Ann. Mag. Nat. Hist., ser. 5, v. 1, p. 433, Pl. 20, Figs. 2a, b.

Bactrammina elongata Eimer and Fickert, 1899, Zeitscher, Woss. Zool., v. 65, p. 673.

Diagnosis. Test elongate, consisting of long tubular portion of small diameter, composed of sand grains, proloculus broadly rounded, usually considerably larger than diameter of tube; wall usually consisting of but single layer of sand grains with varying amount of cement, smooth on interior surface, rougher on exterior; aperture at distal end of tube, little, if at all, constricted; color gray, sometimes brown, depending largely on color of sand grains.

Discussion. This species is represented by a single specimen at station 103.

Hyperammina subnodosa Brady, 1884 (Plate 1, Fig. 2)

Hyperammina subnodosa Brady, 1884, Rep. Voy. Challenger, Zool., v. 9, p. 259, Pl. 23, Figs. 11-14.

Diagnosis. Test elongate, subcylindrical, larger than others of genus, proloculus large, thick walled, tubular chamber of lesser diameter than proloculus usually irregularly constricted at intervals; walls very thick, coarsely arenaceous, somewhat roughened; interior smoother; aperture circular, at distal end of tube; color light grayish.

Discussion. This species is represented by a single specimen at station 103.

GENUS JACULELLA Brady, 1879

Jaculella acuta Brady, 1879 (Plate 1, Fig. 3)

Jaculella acuta Brady, 1879, Quart. Journ. Micr. Sci., v. 19, p. 35, Pl. 3, Figs. 12, 13.

Diagnosis. Test elongate, straight, tubular; proximal end closed, acutely pointed, distal end broader, slightly compressed to form aperture, which is circular; wall thick, composed of coarse sand grains, firmly cemented; exterior rough; proximal end of test often reddish-brown.

Discussion. This species is represented by only a few specimens at station 103.

FAMILY SACCAMMINIDAE Brady, 1884

SUBFAMILY SACCAMMININAE Brady, 1884

GENUS TECHNITELLA Norman, 1878

Technitella legumen Norman, 1878 (Plate 1, Fig. 4)

Technitella legumen Norman, 1878, Ann. Mag. Nat. Hist., ser. 5, vol. 1, p. 279, Pl. 16, Figs. 3, 4.

Diagnosis. Test free, usually elongate, pyriform, subcylindrical, fusiform or elongate oval, consisting of single undivided chamber; wall thin, composed of sponge spicules, fine sand or amorphous white material, spicules usually whole, of nearly same size, those of exterior longitudinally arranged; aperture rounded, at smaller end of test, usually without definite neck; color usually pure white, sometimes grayish.

Discussion. This species is represented by a few specimens at station 1.

FAMILY AMMODISCIDAE Reuss, 1862

SUBFAMILY AMMODISCINAE Reuss, 1862

GENUS AMMODISCUS Reuss, 1862

Ammodiscus anguillae Höglund, 1947 (Plate 1, Fig. 5)

Trochammina incerta (d'Orbigny) Goes, 1882 (part), K. Sv. Vet. Akad. Handl., v. 19, No. 4, p. 136, Pl. 11, Figs. 405, 406.

Ammodiscus incertus (d'Orbigny) Brady, 1884 (part), Rep. Voy. Challenger, Zool., v. 9, p. 330, Pl. 38, Figs. 1, 3.

Ammodiscus incertus (d'Orbigny) Cushman, 1918 (part), Bull. 104, U.S. Nat. Mus., pt. 1, p. 95, Pl. 39, Fig. 1-8.

Ammodiscus anguillae Höglund, 1947, Zool. Bidr. fr. Uppsala, v. 26, p. 128.

Diagnosis. Test large, not especially thin, rather regular in shape; spiral whorls very numerous; sutures between coils distinct; proloculus small; wall arenaceous, composed of sand grains, from about fifth to seventh whorl also of radially arranged sponge spicules neatly cemented together; surface moderately smooth.

Discussion. This species is very rare, with only a single specimen found at station 4.

Ammodiscus tenuis Brady, 1884 (Plate 1, Fig. 6)

Ammodiscus tenuis Brady, 1884, Rep. Voy. Challenger Zool., v. 9, p. 78, Pl. 38, Figs. 5, 6.

Diagnosis. Test free, planispiral, composed of ovoid proloculum followed by long, spirally coiled, undivided second chamber in single plane; in microspheric forms coils very small in

center, gradually increasing toward periphery; in megalospheric form coils much larger in central portion, increasing little toward periphery; adult with outer whorls about as wide as high in transverse section; wall finely arenaceous, usually with excess of cement; color usually yellowish or reddish-brown in fresh specimens, in alcohol often with area around aperture whitish; aperture formed by open end of tube.

Discussion. This species is very rare in the area, a single specimen being found at station 4.

SUPERFAMILY LITUOLACEA de Blainville, 1825

FAMILY HORMOSINIDAE Haeckel, 1894

SUBFAMILY HORMOSININAE Haeckel, 1894

GENUS REOPHAX Montfort, 1808

Reophax dentaliniformis Brady, 1881 (Plate 1, Fig. 7)

Reophax dentaliniformis Brady, 1881, Quart. Journ. Micr. Sci., v. 21, p. 49.

Diagnosis. Test slender, tapering, composed of few (5-6) chambers, increasing progressively in length as added, slightly tumid in middle, contracted slightly at ends; arranged in straight or slightly curved line; wall of rather coarse sand grains, but cemented to give smooth even surface, apertural end tapering rather abruptly to short cylindrical neck; aperture circular; color gray.

Discussion. This species is rare occurring at only four stations three of which are located in the slightly deeper waters of the Gulf of Mexico adjacent to Florida Bay and the other at the very deep station 1.

Reophax difflugiformis Brady, 1879 (Plate 1, Fig. 8)

Reophax difflugiformis Brady, 1879, Quart. Journ. Micr. Sci., v. 19, p. 51, Figs. 3a, b.

Diagnosis. Test free, consisting of single elongate oval or pyriform chamber, with more or less distinct tubular neck; chamber undivided; wall fairly thick, composed of closely cemented sand grains of variable size and roughness; aperture simple, terminal; color varying with material of wall.

Discussion. This species is rare, occurring at only two stations in the Gulf of Mexico waters.

Reophax fusiformis (Williamson), 1858 (Plate 1, Fig. 9)

Proteonina fusiformis Williamson, 1858, Recent Foram. Gt. Brit., p. 1, Pl. 1, Fig. 1.

Reophax fusiformis Brady, 1882, Denkschr. Kongl. Akad. Wiss. Wien, v. 43, pt. 2, p. 99.

Diagnosis. Test free, fusiform, asymmetrical, chamber single or somewhat incompletely divided; walls composed of fairly coarse sand grains, rough externally, but closely cemented; aperture terminal, single.

Discussion. This species is represented by single specimens at two stations.

Reophax nodulosus Brady, 1879 (Plate 1, Fig. 10)

Reophax nodulosus Brady, 1879, Quart. Journ. Micr. Sci. v. 19, p. 52, pl. 4, Figs. 7, 8.

Diagnosis. Test elongate, tapering, straight or slightly curved, composed of several (up to 20) chambers, but usually less than 12, pyriform in shape, widest near basal end, thence tapering toward apertural end, chambers gradually increasing in length and diameter as added;

wall in short chambers rough, in those with elongate chambers usually neatly finished on exterior, composed of sand grains with reddish-brown cement; aperture fairly large, circular.

Discussion. This species is represented by a single specimen at station 1, and is common at station 107. It appears to be restricted to fairly deep water.

Reophax scorpiurus Montfort, 1808 (Plate 1, Fig. 11)

Reophax scorpiurus Montfort, 1808, Conch. Syst., v. 1, p. 330.

Diagnosis. Test consisting of a number of chambers, rapidly increasing in size as added, early chambers more or less indistinct, irregularly arcuate, later ones larger, more distinct, nearly in straight line; walls of coarse sand grains, rather roughly cemented, surface rough; aperture simple, small, with short neck.

Discussion. This species is represented by a single specimen from station 105.

Reophax sp. (Plate 1, Fig. 12)

A single specimen of this large species of Reophax occurs at station 103.

FAMILY LITUOLIDAE de Blainville, 1825

SUBFAMILY HAPLOPHRAGMOIDINAE Mayne, 1952

GENUS HAPLOPHRAGMOIDES Cushman, 1910

Haplophragmoides canariensis (d'Orbigny), 1839 (Plate 1, Figs. 13, 14)

Nonionina canariensis d'Orbigny, 1839, in Barker-Webb and Berthelot, Hist. Nat. Iles Canaries, v. 2, pt. 2, Foraminiferes, p. 128, pl. 2, Figs. 33, 34.

Placopsilina canariensis Parker and Jones, 1857, Ann. Magn. Nat. Hist., ser. 2, v. 19, p. 301, pl. 10, Figs. 13, 14.

Lituola canariensis Carpenter, Parker and Jones, 1862, Intr. Foram., pl. 6, Figs. 39-41.

Lituola nautiloides var. canariensis Parker and Jones, 1865, Philos. Trans., v. 155, p. 406, pl. 15, Figs. 45a, b, pl. 17, Figs. 92-95.

Haplophragmium canariensis Siddall, 1879, Cat. Rec. British Foram., p. 4.

Haplophragmoides canariensis Cushman, 1910, Bull. 71, U.S. Nat. Mus., pt. 1, p. 101, Fig. 149.

Diagnosis. Test free, planispiral, composed of few coils, partially involute or almost completely so, umbilicate; chambers subglobular, somewhat compressed laterally, six or seven chambers in final coil, last chambers somewhat larger than preceding ones, sutures indistinct, periphery somewhat lobulate; wall arenaceous, made up of sand grains, but rather smoothly finished, thin; aperture at base of last-formed chamber, narrow, overhanging portion of wall, slightly extended forming thin lip.

Discussion. This species had rare occurrences at stations 2, 3 and 4 located between the outer reef tract and the Florida Keys.

SUBFAMILY CYLAMMININAE Marie, 1941

GENUS ALVEOLOPHRAGMIUM Shchedrina, 1936

Alveolophragmium subglobosum (G.O. Sars), 1871

Lituola subglobosa G.O. Sars, 1871, Forh. Vid. Selsk. Christiania, p. 253.



Haplophragmium subglobosum Brady, 1881, Denkschr. Kais. Akad. Wiss. Wien, v. 43, p. 100.

Haplophragmoides subglobosum Cushman, 1910, U.S. Nat. Mus., Bull. 71, pt. 1, p. 105.

Alveolophragmium subglobosum Loeblich and Tappan, 1953, Smiths. Misc. Coll., v. 121, no. 7, p. 9.

Diagnosis. Test usually planispiral, consisting of two or more coils, involute, depressed at umbilici, chambers very broad, low; wall arenaceous, somewhat roughened, variable, usually 7 or 8 chambers in last-formed coil making test as whole subglobose; aperture more or less elongated slit at base of apertural face, simple.

Discussion. This species is represented by a single specimen at station 103.

#### SUBFAMILY LITUOLINAE de Blainville, 1825

##### GENUS AMMOBACULITES Cushman, 1910

Ammobaculites agglutinans (d'Orbigny), 1846 (Plate 1, Fig. 15)

Spirolina agglutinans d'Orbigny, 1846, Foram. Foss. Bass. Tert. Vienne, p. 137, pl. 7, Figs. 10-12.

Haplophragmium agglutinans Brady, 1884, Rep. Voy. Challenger, Zool., v. 9, p. 301, pl. 32, Figs. 19, 20, 24-26.

Ammobaculites agglutinans Cushman, 1910, Bull. 71, U.S. Nat. Mus., pt. 1, p. 115, Fig. 176.

Diagnosis. Test elongate, early portion closely coiled, planispiral, one or usually more coils each with 5 to 7 chambers, later portion uncoiled, subcylindrical, made up of linear series of chambers, in adult specimens making up larger part of test; wall rather coarsely arenaceous, somewhat variable in its surface, usually roughened, occasionally fairly smooth; aperture in early coiled portion slit-like, at base of apertural face, in uncoiled portion in middle of terminal face, rounded.

Discussion. This species is represented by a single specimen at station 16.

Ammobaculites sp. (Plate 1, Fig. 16)

Diagnosis. This species is similar to Ammobaculites agglutinans, but differs from it in having a relatively larger coiled portion to uncoiled portion, and in having the coiled portion involute.

Discussion. This species is represented by single specimens at stations 28 and 30.

#### FAMILY TEXTULARIIDAE EHRENBERG, 1838

##### SUBFAMILY SPIROPECTAMMININAE Cushman, 1927

##### GENUS SPIROPECTAMMINA Cushman, 1927

Spiropectammina floridana (Cushman), 1922 (Plate 1, Fig. 17)

Textularia transversaria Flint (not Brady), 1897, Rep. U.S. Nat. Mus., p. 283, pl. 28, Fig. 4.

Textularia floridana Cushman, 1922, Publ. 311, Carnegie Inst. Wash., v. 17, p. 24, pl. 1, Fig. 7.

Diagnosis. Test elongate, two to three times as long as wide, much compressed, periphery acute, ends of chambers forming tubular projections, often broken, showing truncate or concave area which is hollow; initial end rather sharply pointed, apertural end broadly rounded; chambers numerous, thickest near center, increasing somewhat in height toward apertural end; sutures indistinct, slightly if at all depressed; wall finely arenaceous, smooth; aperture small, rounded, at base of inner margin of last-formed chamber.

Discussion. This species occurs only at station 107, but there it is abundant.

SUBFAMILY TEXTULARIINAE Ehrenberg, 1838

GENUS TEXTULARIA DeFrance, 1824

Textularia agglutinans d'Orbigny, 1839 (Plate 2, Fig. 1)

Textularia agglutinans d'Orbigny, 1839, in De la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 136, pl. 1, Figs. 17, 18, 32, 34.

Diagnosis. Test elongate, tapering, compressed, periphery rounded; chambers inflated, increasing in height toward apertural end; sutures distinct, depressed; wall rather coarsely arenaceous, but smoothly finished; aperture an elongate slit in well-marked depression of inner border of chamber.

Discussion. This species has rare occurrences in areas outside Florida Bay proper. It is found between the reef tract and the Florida Keys, and at the stations adjacent to Florida Bay in the Gulf of Mexico.

Textularia candeiana d'Orbigny, 1839 (Plate 2, Fig. 2)

Textularia candeiana d'Orbigny, 1839, in De La Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 143, pl. 1, Figs. 25-27.

Diagnosis. Test elongate, club-shaped, early portion narrow, much compressed, edges almost carinate, slightly tapering to rounded apex, later chambers enlarging rapidly, much inflated; chambers numerous; wall rather coarsely arenaceous; aperture in broad but shallow sinus at base of inner margin of chamber.

Discussion. This species has rare occurrences at four of the Gulf of Mexico stations, all outside of Florida Bay proper.

Textularia conica d'Orbigny, 1839 (Plate 2, Fig. 3)

Textularia conica d'Orbigny, 1839, in De La Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 143, pl. 1, Figs. 19, 20.

Diagnosis. Test usually wider than high, triangular in front view, broadly oval in end view, slightly compressed, apex bluntly pointed; chambers comparatively few, distinct; sutures distinct, slightly depressed; wall arenaceous, smooth, or slightly roughened; aperture narrow slit at base of inner margin of last-formed chamber.

Discussion. A few specimens of this species occur at the two deepest stations only, suggesting a depth control on distribution.

Textularia mayori Cushman, 1922 (Plate 2, Fig. 4)

Textularia mayori Cushman, 1922, Publ. 311, Carnegie Inst. Wash., p. 23, pl. 2, Fig. 3.

Diagnosis. Test compressed, increasing rapidly in breadth, initial end rounded, apertural end obliquely truncate; sutures slightly depressed; periphery of each chamber with elongate, conical, spinose projection, often broken at tip, those of early portion directed backward, later ones extending straight outward; wall arenaceous, of angular sand-grains with much fine cement; aperture very low, elongate, at inner border of last-formed chamber, in reentrant of border, with thin lip above.

Discussion. This species occurs only at stations 106 and 107 located just south of Rebecca Shoals. At these two stations it is common, but it is absent from all other stations, suggesting a probable depth control.

GENUS BIGENERINA d'Orbigny, 1826

Bigenerina irregularis Phleger and Parker, 1951 (Plate 2, Fig. 5)

Bigenerina irregularis Phleger and Parker, 1951, Mem. Geol. Soc. America, v. 46, pt. 2, p. 4, pl. 1, Figs. 16-21.

Diagnosis. Test elongate, initial portion biserial, compressed, usually at angle to rest of test, which is uniserial; wall coarsely arenaceous, composed partially of sand grains from associated sediment, giving whole test roughened appearance; aperture terminal, rounded, at end of short neck.

Discussion. This species has rare to abundant occurrences at all the stations in the adjacent Gulf of Mexico waters. It is absent from all the Florida Bay stations.

Bigenerina nodosaria d'Orbigny, 1826 (Plate 2, Fig. 6)

Bigenerina nodosaria d'Orbigny, 1826, Ann. Sci. Nat., v. 7, p. 261, pl. 11, Figs. 9-11.

Diagnosis. Test elongate, early portion composed of biserial group of chambers, considerably flattened, with sutures clearly marked externally; chambers progressively broader, later portion composed of uniserial group of chambers, rounded, usually less in width than biserial portion; wall usually coarsely arenaceous, sometimes of fine material nearly smooth; aperture in early portion as in Textularia, elongate slit between base of inner margin of chamber and adjacent wall of preceding chamber, in later portion rounded, in middle of terminal face of chamber.

Discussion. This species has a generally common occurrence at all the adjacent Gulf of Mexico stations while absent from Florida Bay.

Bigenerina textularoidea (Goes), 1894 (Plate 2, Fig. 7)

Clavulina textularoidea Goes, 1894, Kongl. Sv. Vet. Akad. Handl., v. 25, p. 42, pl. 8, Figs. 387-399.

Diagnosis. Early portion biserial, lanceolate, much compressed, abbreviated, later portion uniserial, making up major part of test; wall usually very coarsely arenaceous; aperture in early portion at inner margin of last-formed chamber, semilunar, in later portion subrounded, in middle of terminal face of chamber, on short neck.

Discussion. This species occurs only at stations 102 and 103 where it is common and abundant respectively.

FAMILY TROCHAMMINIDAE Schwager, 1877

SUBFAMILY TROCHAMMININAE Schwager, 1877

GENUS TROCHAMMINA Parker and Jones, 1860

Trochammina japonica Ishiwada, 1950 (Plate 2, Figs. 8, 9)

Trochammina japonica Ishiwada, 1950, Japan Geol. Survey, Bull., Kawasaki, Japan, v. 1, no. 4, p. 190, pl. , Figs. 2a-c.

Diagnosis. Test free, trochospiral, periphery broadly rounded, umbilical area in ventral side deeply depressed; 5 or 6 chambers in final whorl, inflated, slightly loculate; sutures indistinct in early stages, depressed, not curved, oblique to inner margin on dorsal side, perpendicular to periphery on ventral side; wall rather coarsely arenaceous, smoothly finished; aperture semi-circular opening at base of ventral side of chamber.

Discussion. This species occurred only at station 28 in the northern part of Florida Bay, but there it is common. The arenaceous material of the wall is loosely held together by cement and therefore the test is very fragile. The distribution of this species is probably more

widespread than these results show, but due to the nature of the wall the test probably disintegrates shortly after death.

FAMILY ATAXOPHRAGMIIDAE Schwager, 1877

SUBFAMILY GLOBOTEXTULARIINAE Cushman, 1927

GENUS KARRERIELLA Cushman, 1933

Karrerietta bradyi (Cushman, 1937) (Plate 2, Fig. 10)

Gaudryina pupoides Brady, 1884, Rep. Voy. Challenger, Zool., v. 9, p. 378, pl. 46, Figs. 1-4.

Gaudryina bradyi Cushman, 1911, Bull. 71, U.S. Nat. Mus., pt. 2, p. 67.

Karrerietta bradyi Cushman, 1937, Cush. Lab. Foram. Res., Spec. Publ. No. 8, p. 135.

Diagnosis. Test stout, somewhat elongate, tapering slightly until near initial end where it tapers abruptly to somewhat blunt end; triserial portion nearly circular in cross section, chambers few, later biserial portion making up about three-fourths of test, slightly compressed; chambers overlapping, appearing crowded, broadly elliptical in cross section, inflated; sutures deep, distinct, end strongly convex; wall of fine arenaceous or calcareous shell material, smooth; aperture oval, slightly back from inner margin of chamber, with border raised somewhat, thickened.

Discussion. This species occurs as a single specimen at station 102.

SUBFAMILY VALVULININAE Berthelin, 1880

GENUS VALVULINA d'Orbigny, 1826

Valvulina oviedoiana d'Orbigny, 1839 (Plate 2, Fig. 11)

Valvulina oviedoiana d'Orbigny, 1839, in De la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 103, pl. 2, Figs. 21, 22.

Diagnosis. Test pyramidal, triangular in transverse section, initial end pointed, apertural end broadly rounded, triserial; wall coarsely arenaceous, principally of sand grains from associated sediment, somewhat roughened; aperture at base of inner margin of last-formed chamber.

Discussion. This species is randomly distributed at ten stations throughout Florida Bay. It displays a wide variation in size and in the nature of its tooth-plate (Lynts, 1964). It appears to be more common in areas of coarse sediment.

GENUS CLAVULINA d'Orbigny, 1826

Clavulina difformis (Brady), 1884 (Plate 2, Fig. 12)

Clavulina angularis d'Orbigny, var. difformis Brady, 1884, Rep. Voy. Challenger, Zool. v. 9, p. 396, pl. 48, Figs. 25-31.

Clavulina difformis (Brady) Cushman, 1921, Bull. 100, U.S. Nat. Mus., v. 4, p. 156, pl. 31, Figs. 2a, b.

Diagnosis. Test elongate, quadrilateral in cross section, early triserial portion limited to few chambers, followed by few chambers biserial in character, main portion of test uniserial, chambers extending back along angles of test, arched upward across faces, leaving slight hollow below; wall arenaceous, smoothly finished on exterior; aperture in middle of apertural face, with single valvular tooth.

Discussion. This species is represented by a single specimen at station 73.

Clavulina mexicana Cushman, 1922 (Plate 2, Fig. 13)

Clavulina parisiensis d'Orbigny, var. humilis Flint (not Brady), 1897, Rep. U.S. Nat. Mus., p. 289, pl. 36, Fig. 1.

Clavulina humilis Brady, var. mexicana Cushman, 1922, U.S. Nat. Mus., Bull. 104, pt. 3, p. 83, pl. 16, Figs. 1-3.

Pseudoclavulina mexicana (Cushman), 1937, Cush. Lab. Foram. Res., Spec. Publ. 7, p. 117, pl. 16, Figs. 5-11.

Diagnosis. Test elongate, early portion sharply triangular, chambers of early portion becoming somewhat more separate, distinct as added, those of last-formed portion flask-shaped with definite neck; sutures indistinct in triserial portion, those of later portion becoming somewhat more distinct, depressed; wall coarsely arenaceous, surface roughened, fairly thick; aperture terminal, central, at end of tubular neck.

Discussion. This species occurs at only two stations in very low frequencies.

Clavulina tricarinata d'Orbigny, 1839 (Plate 2, Fig. 14)

Clavulina tricarinata d'Orbigny, 1839, in De la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 111, pl. 2, Figs. 16-18.

Diagnosis. Test elongate, early portion triserial, later portion forming large part of test uniserial, triangular in cross section; chambers numerous, angles extending back over preceding chambers; wall coarsely arenaceous, principally of calcareous sand grains from associated sediment; aperture circular, terminal, often with distinct, straight, simple tooth.

Discussion. This species occurs at only eight stations in frequencies from low to medium.

SUBFAMILY ATAXOPHRAGMIINAE Schwager, 1877

GENUS LIEBUSELLA Cushman, 1933

Liebusella soldanii (Jones and Parker), 1860 (Plate 2, Fig. 15)

Lituola soldanii Jones and Parker, 1860, Quart. Journ. Geol. Soc., v. 16, p. 307, No. 184.

Haplostiche soldanii Brady, 1884, Rep. Voy. Challenger, Zool., v. 9, p. 318, pl. 32, Figs. 12-18.

Liebusella soldanii Thalmann, 1937, Eclog. geol. Helvet., v. 30, No. 2, p. 340.

Diagnosis. Test elongate, subcylindrical or ovate, inferior end round or tapering to blunt point, superior end broad, rounded; consisting of numerous, convex, slightly embracing chambers, superimposed in straight or somewhat curved line; exterior rough, slightly constricted at sutures; interior of chambers subdivided by irregular secondary septa; aperture terminal, porous or dendritic.

Discussion. This species is represented by only a few specimens at stations 101, 102 and 103. The specimens are large and seem to be associated with coarse sediment.

FAMILY PAVONITIDAE Loeblich and Tappan, 1961

SUBFAMILY PAVONITINAE Loeblich and Tappan, 1961

GENUS TEXTULARIELLA Cushman, 1927

Textulariella barrettii (Jones and Parker), 1863 (Plate 3, Fig. 1)

Textularia barrettii Jones and Parker, 1863, Rep. British Ass., Newcastle Meeting, p. 80, 105.

Textulariella barrettii Cushman, 1927, Contr. Cush. Lab. Foram. Res., v. 3, pt. 1, No. 39, p. 24.

Diagnosis. Test tapering, about twice as long as broad, very slightly compressed, broadest near apertural end, apical end bluntly pointed, later portion of test often with nearly straight sides; chambers distinct, numerous, labyrinthic; sutures very clearly marked, not depressed; walls finely arenaceous with abundance of cement, very smoothly finished; aperture narrow slit at base of inner margin of last-formed chamber, sides of chamber slightly projecting beyond it on each side, sometimes subdivided into one or more openings.

Discussion. This species had rare occurrences at stations 101, 102 and 103.

SUBORDER MILIOLINA DeLage and Herouard, 1896

SUPERFAMILY MILIOLACEA Ehrenberg, 1839

FAMILY FISCHERINIDAE Millett, 1898

SUBFAMILY CYCLOGYRINAE Loeblich and Tappan, 1961

GENUS CYCLOGYRA Wood, 1842

Cyclogyra involvens (Reuss), 1850 (Plate 3, Fig. 2)

Operculina involvens Reuss, 1850, Denkschr. Akad. Wiss. Wien., v. 1, p. 370, Pl. 46, Fig. 30.

Cornuspira involvens Reuss, 1863, Sitz. Akad. Wiss. Wien, v. 48, Abt. 1, p. 39, Pl. 1, Fig. 2.

Diagnosis. Test nearly circular in side view, consisting of proloculum and long, closely coiled, planispiral second chamber of nearly equal diameter throughout; wall smooth, polished; aperture terminal, nearly size of open end of tube.

Discussion. This species differs from Cyclogyra planorbis in having a greater number of coils, and in not increasing the diameter of the second chamber during growth.

This species occurs at only nine stations in very low frequencies.

Cyclogyra planorbis Schultze, 1854 (Plate 3, Fig. 3)

Cornuspira planorbis Schultze, 1854, Organismus Polythal., p. 40, Pl. 2, Fig. 21.

Diagnosis. Test circular in side view, consisting of proloculum and long second chamber planispirally coiled, making only few coils; diameter of tube increases with growth; wall smooth; aperture open end of tube.

Discussion. Cyclogyra planorbis is similar to Cyclogyra involvens, but differs from it in possessing fewer coils and in increasing the diameter of the second chamber during growth.

This species occurs at thirteen stations, usually in low frequencies. It appears to be restricted to those stations with the finest-grained sediment.

GENUS CORNUSPIROIDES Cushman, 1928

Cornuspiroides foliacea (Phillipi), 1844 (Plate 3, Fig. 4)

Orbis foliaceus Phillipi, 1844, Enum. Moll. Sicil., v. 2, p. 147, Pl. 24, Fig. 26.

Cornuspira foliacea Carpenter, Parker and Jones, 1862, Intrad. Foram., p. 68, Pl. 5, Fig. 16.

Diagnosis. Test planispiral, early portion with coils of nearly uniform diameter, later coils rapidly increasing in height, forming broad, flattened test; wall smooth, except for thickening caused by lines of growth; aperture long, narrow slit entire height of chamber, at open end of tube.

Discussion. This species is represented by single specimens at stations 18 and 103.

FAMILY NUBECULARIIDAE Jones, 1875

SUBFAMILY OPHTHALMIDIINAE Wiesner, 1920

GENUS CORNULOCULINA Burbach, 1886

Cornuloculina inconstans (H.B. Brady), 1879 (Plate 3, Figs. 5, 6)

Hauerina inconstans Brady, 1879, Wuart. Journ. Micro. Sci., v. 19, p. 268.

Ophthalmidium inconstans Brady, 1884, Rep. Voy. Challenger, Zool., v. 9, p. 189, Pl. 12, Figs. 5, 7, 8.

Hauerinella inconstans (Brady) Schubert, 1920, Pal. Zeitschr., v. 3, p. 162.

Diagnosis. Test much compressed, planispiral; chambers consist of globular proloculum followed by long planispirally coiled second chamber, making two or more coils; chambers nearly circular in transverse section with wide flange on peripheral border; chambers often slightly less coiled toward apertural end, leaving space filled by thin plate of calcareous material; aperture circular without lip or tooth.

Discussion. Cornuloculina inconstans exhibits variation in the size of the flange on the peripheral border. Some specimens have very thin flanges, while others have very narrow and slightly thicker flanges.

This species occurs at ten stations, always in very low frequencies.

SUBFAMILY SPIROLOCULININAE Wiesner, 1920

GENUS SPIROLOCULINA D'Orbigny, 1826

Spiroloculina antillarum d'Orbigny, 1839 (Plate 3, Fig. 7)

Spiroloculina antillarum d'Orbigny, 1839, in De la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 166, Pl. 9, Figs. 3, 4.

Diagnosis. Test elongate, elliptical; chambers nearly circular in cross section, surface ornamented by numerous longitudinal costae, both ends of last-formed chamber projecting; sutures distinct; apertural end projecting, forming cylindrical neck, with slight lip, single tooth, sometimes bifid at tip.

Discussion. This species is relatively rare, occurring at only nine stations and always in low frequencies.

Spiroloculina arenata Cushman, 1921 (Plate 3, Fig. 8)

Spiroloculina arenata Cushman, 1921, Proc. U.S. Nat. Mus., v. 59, p. 63, Pl. 14, Fig. 17.

Diagnosis. Test compressed; chambers in single plane, each narrowing towards aperture, both ends of last-formed chamber projecting beyond ends of preceding chamber; sutures indistinct; wall agglutinated, principally of rather coarse sand grains from associated sediment; aperture round, on prominent neck.

Discussion. Spiroloculina arenata differs from other species of Spiroloculina in the area in having an agglutinated wall.

This species is relatively rare, occurring at only nine stations, always in very low frequencies.

Spiroloculina caduca Cushman, 1922 (Plate 3, Fig. 9)

Spiroloculina caduca Cushman, 1922, Publ. 311, Carnegie Inst. Wash., p. 61, Pl. 11, Figs. 3, 4.

Diagnosis. Test broadly elliptical, much compressed, apertural end extended; chambers of adult with sharp translucent keel, usually somewhat lobulated; sutures slightly depressed; surface of chambers with irregular raised costae, more or less oblique in position; wall very thin, brittle; aperture at end of cylindrical neck, rounded, with simple tooth; surface smooth, shining.

Discussion. This species is represented by a few specimens at station 17.

Spiroloculina communis Cushman and Todd, 1944 (Plate 3, Fig. 10)

Spiroloculina grateloupi d'Orbigny, 1826, Ann. Sci. Nat., v. 7, p. 298.

Spiroloculina excavata Brady, 1884, Rep. Voy. Challenger, Zool., v. 9, p. 151, Pl. 9, Figs. 5, 6.

Spiroloculina communis Cushman and Todd, 1944, Cush. Lab. Foram. Res., Spec. Publ. No. 11, p. 63.

Diagnosis. Test elongate, broadest in center, tapering toward either end; chambers rapidly thickening as added, in end view periphery much the broadest portion of test, central portion deeply excavated; periphery of chambers in end-view convex, especially in central portion, edges broadly rounded; chambers evenly curved, final chamber somewhat projecting, both at base and lip, aperture itself rounded, with either single tooth with bifid tip, two projections forming concave extremity, or in some cases a pair of such bifid teeth opposite one another; surface of test dull, somewhat roughened.

Discussion. A single specimen of this species occurs at station 107.

Spiroloculina cf. S. costifera Cushman, 1917 (Plate 3, Fig. 11)

Spiroloculina costifera Cushman, 1917, U.S. Nat. Mus., Bull. 71, pt. 6, p. 34, Pl. 6, Figs. 1-3.

Diagnosis. Test large, planispiral, chambers few in number, early ones close coiled, later ones with tip of apertural end standing away from previous chamber, next chamber added often not filling gap thus made, in adult not reaching to base of preceding chamber; sutures indistinct; surface of test with few longitudinal coarse costae running whole length of chamber; apertural end of chamber produced to form elongated neck which has well-developed phialine lip, single tooth on inner margin of aperture which is flattened on inner side; wall smooth, except for costae, dull.

Discussion. This species is represented by a single specimen at station 16.

Spiroloculina ornata d'Orbigny, 1839

Spiroloculina ornata d'Orbigny, 1839, in De la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 167, Pl. 12, Fig. 7.

Diagnosis. Test elongate, compressed, biconcave in side view; chambers in single plane, both ends projecting beyond ends of preceding chambers, apertural end extends considerable distance beyond rest of test, last-formed chamber ornamented with secondary costae; wall smooth; aperture quadrangular, on end of very prominent neck, with simple tooth.

Discussion. This species is rare, single specimens occurring at stations 35, 38 and 78.



Spiroloculina planulata (Lamarck), 1805 (Plate 3, Fig. 12)

Miliolites planulata Lamarck, 1805, Ann. Mus., v. 5, p. 352, no. 4.

Spiroloculina planulata Macdonald, 1857, Ann. Mag. Nat. Hist., ser. 2, v. 20, p. 153, Pl. 6, Fig. 28.

Diagnosis. Test irregularly elliptical, periphery concave; apertural end very slightly projecting; chambers in single plane; surface matte; aperture with slight lip, elongate tooth, slightly bifid at tip.

Discussion. The spiroloculine nature of the few specimens present in this area can be seen only by wetting the tests. It is a rare species, single specimens occurring at stations 78, 95, 96 and 106.

Spiroloculina rotunda d'Orbigny, 1826 (Plate 3, Fig. 13)

Frumentaria sigma Soldani, 1789, Testaceographiae etc., Siena, Italy, 4, p. 229, tab. 154, Figs. hh, ii.

Spiroloculina rotunda d'Orbigny, 1826, Ann. Sci. Nat., ser. 1, v. 7, p. 299.

Diagnosis. Test large, nearly circular in outline, chambers in single plane, periphery of chambers rounded, basal end very slightly projecting; sutures distinct; wall smooth; aperture with lip, elongate tooth, slightly bifid at tip.

Discussion. This species is rare, occurring in low frequencies at stations 2, 3 and 4, which are located between the reef track and the Florida Keys. No specimens occur within Florida Bay proper.

Spiroloculina soldanii Fornasini, 1886 (Plate 4, Fig. 1)

Spiroloculina soldanii Fornasini, 1886, Boll. Soc. geol. Ital., vol. 5, p. 25.

Diagnosis. Test large, about one and one-half times as long as broad, thick, strongly concave, periphery flat or slightly concave, sharply angled, limbate at margins; chambers numerous, strongly projecting beyond neck of previous chamber at base, extending into prominent, slightly recurved neck at apertural end; sutures depressed; wall covered with minute, longitudinal, incised lines parallel to periphery; aperture quadrangular, broadened at outer end, with long bifid tooth.

Discussion. Although there is no record of Spiroloculina soldanii from this area, I have tentatively placed the single specimen from station 1 in this species for it closely resembles comparative specimens from the USNM collections.

SUBFAMILY NODOBACULARIINAE Cushman, 1927

GENUS NODOBACULARIELLA Cushman and Hanzawa, 1937

Nodobaculariella cassis d'Orbigny, 1839 (Plate 4, Fig. 2)

Vertebralina cassis d'Orbigny, 1839, in De la Sagra, Hist. Phys. Pol. Nat. Cuba, "Foraminiferes", p. 51, Pl. 7, Figs. 14, 15.

Diagnosis. Test compressed, early portion close-coiled, somewhat involute, uncoiled portion usually consisting of one or two chambers; periphery of each chamber with broad, thin keel; surface ornamented with numerous ornamented, somewhat oblique costae; aperture elongate, with everted lip.

Discussion. All specimens of this species were found with only one chamber in the uncoiled portion of the tests. Superficially they resemble specimens of Articulina mucronata, having only single chambers in their uncoiled portions, but differ from them in having a planispiral instead of triloculine early portion and in possessing a thin keel on the periphery of each